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ABSTRACT

The rapid infusion of the Internet into public schools makes it possible for students and teachers to participate in a range of literacy events as well as access reading resources previously unavailable to them in the classroom. This report outlines a study which explored literacy researchers and lead teachers' thinking about the benefits of Internet-based curricular activities and instructional practices used to enhance students' literacy. The report cites the primary questions that guided the inquiry: What are the literacy skills students need to use the Internet within curriculum?; How are these literacy skills the same as for using printed books and paper-based writing and how are they different?; and What literacy guidelines would help teachers prepare their students to use the Internet effectively? It states that the specific strategies investigated relate to several of the English language arts standards and National Educational Technology Standards for students and teachers. It explains that three sources of data were used in forming the report: (1) five outstanding researchers in technology and literacy were interviewed by telephone; (2) 13 teachers who use the Internet extensively for literacy learning were interviewed; and (3) an online survey of teachers and staff developers was conducted to gather descriptive information about Internet-based literacy learning in the classroom. The report finds that researchers and teachers indicate a number of educational benefits of Internet-based curricular activities. Contains 11 notes, 5 tables of data, and 51 references. (NKA)

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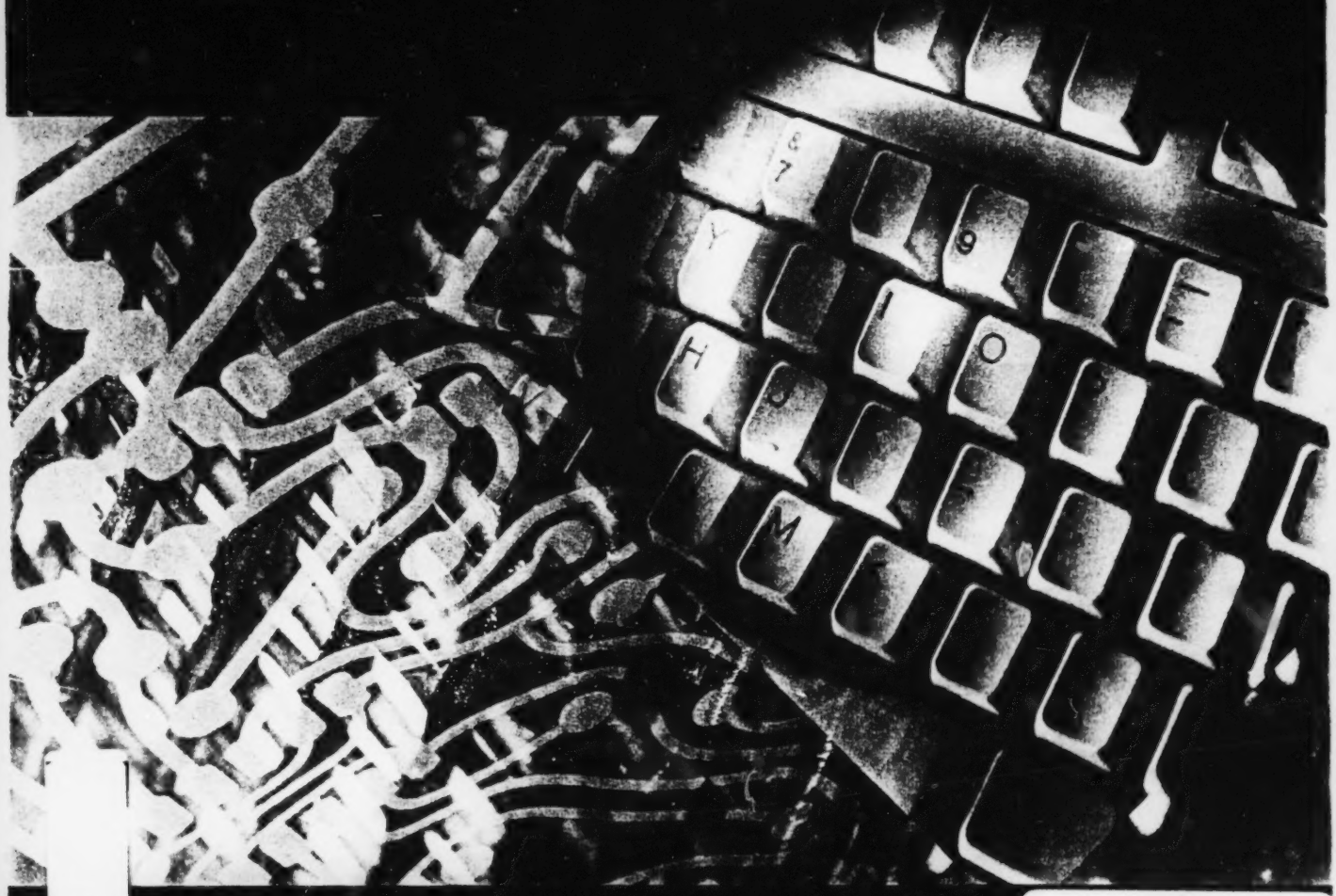
Literacy Learning on the Net:

An Exploratory Study



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Literacy Learning on the Net: *An Exploratory Study*

November 2000

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Reading, writing, and oral language are the bedrock subjects of the curriculum, for they develop the competencies on which virtually all subsequent instruction and learning depends.

James R. Squire
Handbook of Research on Improving Student Achievement, 1995

Introduction

The purpose of the study was to explore literacy researchers and lead teachers' thinking about the benefits of Internet-based curricular activities and instructional practices used to enhance students' literacy. The rapid infusion of the Internet into public schools makes it possible for students and teachers to participate in a range of literacy events as well as access reading resources previously unavailable to them in the classroom.[1] The primary questions that guided the inquiry included: What are the literacy skills students need to use the Internet within curriculum? How are these literacy skills the same as for using printed books and paper-based writing? How are these literacy skills different from those needed when using printed books and engaging in print-based writing? What literacy guidelines would help teachers prepare their students to use the Internet effectively? The specific strategies investigated relate to several of the standards for the English language arts (National Council of Teachers of English and International Reading Association [NCTE/IRA], 1996) and National Educational Technology Standards (International Society for Technology in Education [ISTE], 1999 and 2000) for students and teachers.

Background

English language arts educators and researchers have been grappling with the effects of computers on reading since the 1960s and on writing since the late 1970s (Reinking & Bridwell-Bowles, 1996; Selfe & Hilligoss, 1994). Some have studied the historical influence of the printing press and its impact on the nature of written communication and conclude: "Technology has frequently played a dominant role in defining what reading and writing skills have been considered important, as well as how and to whom they were taught" (Reinking & Bridwell-Bowles, 1996, p. 310). Even new terms such as Web-based literacy, electronic literacy, digital literacy, and digital learning are beginning to show up in our everyday vocabulary. These words represent a trend toward new dimensions of literacy and curricular goals. "Educational goals are tied to learning environments, as one changes so must the other. Literacy goals 100 years ago for many students were to be able to read and write names, copy and read texts, and generate lists of merchandise. Literacy goals of today require mastery over many different genres of writing, persuasive, expressive, expository, procedural and expect students to be able to interpret, compare, contrast, and analyze complex texts" (Riel, 2000).

In recent years, a few literacy researchers have focused much attention on the Internet. According to Blanchard (1996), telecommunications change how teachers and students share information and ideas across all disciplines. He defines telecommunications as consisting of telephone, radio, television, videotapes, compact and laser discs, computers, and satellite technologies brought together through a networked, multimedia information infrastructure called the Internet. Leu and Kinzer (2000) describe the impact of information and communication technologies, such as the Internet, on the context for literacy and learning in the twenty-first century. Their analysis is based on what research indicates as the major cultural forces affecting changes in literacy education. It is *not* based on efficacy research that demonstrates the effects of information and communication technologies (ICT) on student learning as some researchers and policymakers have called for in recent years. Rather, they report: "A preeminent group of scientists and educational researchers in the Unites States recently argued that ICT and other digital technologies were so central to the nation's future that additional data on their efficacy were unnecessary before systemically integrating these technologies into schools" (as cited by the authors from the President's Committee of Advisors on Science and Technology, 1997). In other words, cultural forces are compelling enough to validate the use of the Internet for educational purposes.

Cultural forces are important to literacy education that is traditionally based on the premise of preparing children for their life's opportunities. Leu and Kinzer (2000) examine the powerful influence cultural forces historically have on literacy: "Ultimately, the forms and functions of literacy as well as literacy instruction itself are largely

determined by the cultural forces at work within any society" (p. 111). They review three prominent cultural forces currently at play. One prominent cultural force is global economic competition. In the foreseeable future, one's opportunities increasingly will depend upon online collaboration and communication, problem identification, information access, information evaluation, and information application skills. Another prominent cultural force involves public policy initiatives aimed at raising levels of literacy achievement via efforts to infuse information and communication technologies, such as the Internet, and new state standards and assessments into the curriculum. The third cultural force Leu and Kinzer discuss is the rapid technology innovation cycle. They argue that those who are literate will adapt easily to using new versions of Internet browsers, operating systems, word processing programs, email, and chat and conferencing software for information and communication tasks. Although this list of technology functions is culturally pertinent today, it may not be tomorrow as Internet technology continues to evolve rapidly.

According to our analysis, the findings from this study fall into four primary categories, which are:

1. Reasons for using the Internet in education
2. Curricular activities involving information research on the Internet, participating in online learning communities, and electronic writing and Web publishing
3. Related instructional strategies
4. Professional development for teachers

Each of these categories appears as a section in this report. Each section starts with a review of pertinent literature on the topic, followed by researcher and teacher perspectives gleaned from analysis of the interviews, observations, and survey responses. Web sites recommended by the researchers involved in this study are listed in sidebars throughout this report to provide readers with the opportunity for their own investigation of best practices for literacy learning on the Internet.

Methods Used to Conduct the Study

Three sources of data were used in forming this report. First, five outstanding researchers in the area of technology and literacy were interviewed by telephone. Since this field is evolving so quickly, the study aimed to tap the latest insights of leading researchers to supplement a review of the published literature and to refine the questions for teacher interviews and an online survey. The researchers were located by identifying those involved in major publications and conferences on the topic of "literacy and technology" during the past five years. From the list and resulting referrals, five researchers agreed to an interview. The researcher questions were semi-structured with questions based on the following English language arts standards and National Educational Technology Standards [NETS] for students and teachers:[2]

- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (such as print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purposes and audience.
- Students use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities (NCTE/IRA, 1996, p. 3).

The above three standards also correlate to and overlap with the ISTE's NETS for students for using productivity, communication, and research tools (ISTE, 1999). In addition, the following NETS for teachers (ISTE, 2000) provided a focus for interview questions:

- Apply current research on teaching and learning with technology when planning learning environments and experiences.
- Facilitate technology-enhanced experiences that address content standards and student technology standards.
- Use technology to support learner-centered strategies that address the diverse needs of learners.

A second source of data came from interviews and observations with teachers who are using the Internet extensively for literacy learning. Thirteen teachers from seven states were interviewed, including eight who teach high school, three who teach middle school, one elementary school teacher, and one who spanned grades K-12. Of those 13, five teachers also were

observed with their students while using the Internet during classroom activities.[3] Nominations of teachers to participate in the study were solicited from the IRA, NCTE, ISTE, and the researchers interviewed for the study. We contacted all nominated teachers by phone or email and requested their participation. In some cases, nominees recommended additional teachers to include; these recommended teachers were also contacted. In all, the authors contacted 37 teachers. The interview questions and observation protocol used with the teachers were also semi-structured with questions based on the English language arts standards and NETS for students and teachers identified above.[4]

Third, we conducted an online survey of teachers and staff developers to gather descriptive information about Internet-based literacy learning in the classroom. The study was not intended to generate a representative sample of U.S. teachers. Instead, the research sought to gather in-depth information from teachers who are relatively advanced in their classroom uses of the Internet for literacy learning. The aim of the study was to hear firsthand from classroom teachers about the benefits that accrue from Internet use, the literacy skills students need to use this tool effectively, the instructional strategies teachers find effective, and the professional development they believe teachers need to capitalize on the Internet's potential. To obtain such information, it was necessary to target survey respondents with significant experience in classroom uses of the Internet, rather than a broader sample of teachers. Because of the nature of the sample and its small size, however, the data reported here should not be regarded as representative of the views and experiences of U.S. teachers. The report's findings are meant instead to identify emerging issues and suggest areas where additional research may be warranted.

The focal point for the study was gleaned from a focus group discussion held at the 2000 National Educational Computing Conference in Atlanta, Georgia, in June 2000. In addition, survey instruments from several related studies (Norris & Soloway, 2000; Center for the Improvement of Early Reading Achievement, 1998; Becker, 1999) informed the questions asked during this study. In addition, data from the interviews with the researchers and the lead teachers informed the development of questions for the online survey (see the Appendix for the survey instrument).

To elicit survey participation, an announcement explaining the purpose of the survey with a direct link to the survey URL was sent via an email list. Those on the list were teachers who had not been interviewed but were referred from the IRA, NCTE, and ISTE, as well as members of the 21st Century Teachers' Network and teachers and development staff who participated in the invitational national and regional conferences on evaluating technology in education during 2000. We employed "snowball sampling" by encouraging recipients of the emailed survey announcement to send the announcement to other teachers who would qualify for the survey. Respondents completed the survey by entering their responses in an online form. Seventy-one unique responses to the survey were received from October 10 to October 23, 2000. Of these survey responses, 15 were disqualified because respondents indicated less than 15 minutes per week of Internet use by either themselves or their students (see Questions 1 and 2). Twenty-three of the remaining 56 respondents received the original announcement; 13 did not; and 21 did not provide enough identifying information for us to determine whether they were among the original recipients of the announcement.

Of the 56 survey respondents to the online survey, 42 were classroom teachers. The remaining 14 had occupations in which they provided staff development with teachers and students related to Internet-based literacy learning.[5] Eight of the classroom teachers also reported performing staff development services for other teachers. The survey respondents represented 25 states from all regions of the country. A plurality of respondents (24) hailed from rural areas, with 22 reporting suburban locations and 10 reporting urban.[6] Survey Question 34 asked respondents to indicate all grade levels that they were currently teaching, including each grade from K-12, preservice, and inservice. Within the K-12 setting, respondents were most likely to teach middle school (21), followed by elementary (18) and high school (18).[7] In addition, 24 respondents indicated providing inservice to teachers, and nine listed preservice. Since the call for participation in the survey targeted English language arts standards, it is not surprising that 41 survey respondents reported teaching that discipline. In decreasing order of prevalence, survey respondents also indicated they taught history/social studies (40), science (39), interdisciplinary studies (34), mathematics (30), fine arts (23), and health (16). Among those who taught English language arts, all but two reported teaching at least one other subject, and 25 said they taught four or more other subjects.[8]

Context for Internet Use Among Survey Respondents

Time online

Most survey respondents (42) indicated that they used the Internet for more than 90 minutes per week, the highest usage category offered in the survey. Ten others reported 46-90 minutes per week, and four reported 15-45 minutes. By contrast, most survey respondents (28) reported that their *students* used the Internet 15-45 minutes per week. Sixteen respondents said their students use the Internet more then 90 minutes per week, and the remaining 12 reported 46-90 minutes.[9]

Internet access

All survey respondents had Internet access in their classrooms, and almost all (51) had access at home as well. Fewer respondents cited additional access in a resource center (41) or an administrative office (39). Thirty respondents had access in all four places, and another 25 had access in two or three locations. Large majorities of respondents also reported that their students had access in their classrooms (50), in a school computer lab (46) or in a school media center (41). Many (35) said their students had access in all three places.[10]

Acceptable uses

Allowable uses of the Internet under the acceptable use policies at survey respondents' institutions included (in order of prevalence) information research (53), participation in collaborative projects (47), Web publishing (41), email correspondence (32) and participation in online discussions (28). A majority of respondents (31) reported that their institutions allowed four or five of these uses.[11]

Reasons for Using the Internet in Education

In the past, independent learning strategies have been favored in school classrooms; in the future, this type of learning may disadvantage children where collaborative strategies become essential for keeping up with changes in the technologies of literacy.

Donald J. Leu, Jr., and Charles K. Kinzer
Reading Research Quarterly, Jan/Feb/March 2000

Literature Review

Literacy is fast growing as a basic skill for Internet-based learning as well as an avenue to increased productivity in the workforce. Fifty years ago, 20 percent of our jobs were professional, 20 percent skilled, and 60 percent unskilled (Murnane & Levy, 1996). "In the 1990s, the percentage of professional jobs is about the same, but skilled jobs have soared to sixty-plus percent while unskilled jobs have fallen below twenty percent" (p. vii). In a third-year report on the telecommunications and information technology gap in America, the National Telecommunications and Information Administration (NTIA) concludes: "Most significantly, people are using the Internet to improve and advance their current status. For example, those who are unemployed are using the Internet to find jobs, and those with lower incomes and many minorities are using the Internet to take courses or do school research" (NTIA, July 1999b, p. 40).

This could be encouraging, however, another recent NTIA report found that: "Though the Internet is consistently touted as the newest educational tool with the potential to narrow demographic disparities, the data shows that only those who have already attained educational success are using the Internet in large numbers. Consequently, Americans with less education, who could perhaps benefit most from the Internet's educational value, are being left behind" (NTIA, July 1999a, p.1).

While our economy, driven in part by technology innovations, is growing new jobs with new skill demands, the skills taught in most schools have changed very little. Among the new set of skills are "reading abilities at levels much higher than many high school graduates

Table 1

The survey asked respondents: "In my opinion, use of the Internet plays a significant role in helping my students achieve the following:"

Rank order of uses of the Internet for student achievement in the areas listed	***Frequency of response*** n = 56
Self-directed learning	53
Information research skills	53
Vocabulary development	42
Process writing skills	42
Engagement in learning community discussions	39
Comprehension of narrative text	38
Publishing for real audiences	38
Personal engagement in reading and writing activities	38
Comprehension of expository text	33
Written responses to expository text	26
Written responses to literature	25

According to most of the teachers who answered the survey, Internet use plays a significant role in helping their students engage in self-directed learning (53) and information research (53). Many of those teachers also said that using the Internet helps student develop their vocabulary (42) and process writing skills (42). Conversely, only 26 of the teachers surveyed said that Internet use plays a significant role in helping students conduct written responses to literature and expository text. This may be due, in part, to limited use of the Internet's collaborative features within this group of teachers.

now attain" and "the ability to use personal computers to carry out simple tasks" (Murnane & Levy, 1996, p. 9). The rapid infusion of the Internet into the fabric of American culture makes reading and writing even more demanding. The Internet is becoming a prominent resource for information, learning, and collaborative teamwork. Of particular concern to some researchers and educators are the high levels of literacy and technology fluency that the Internet requires of its users.

The literature points out that schools are lagging behind in understanding the literacy demands generated by information and communication technologies such as the Internet. Teachers and their students, in general, are not engaging in the full range of information and communication activities that could have educational and professional development benefits. In a national survey conducted in the spring of 1998 with 2,250 Grade 4 through Grade 12 teachers in U.S. public and private schools, Becker (2000) found only 16 percent of teachers communicated by email with teachers from other schools as often as five times during the school year. And, only 18 percent of teachers posted information, suggestions, opinions, or student work on the World Wide Web during that time. In the same study, Becker (1999) also found that 68 percent of teachers use the Internet to locate information resources to supplement their lesson plans. According to Becker (1999), the statistics suggest, "the Internet has begun to be established as an information and communications resource in the working and home environments of most teachers" (p. 3).

Regular use of the Internet in the classroom does cause changes in the educational process. Case studies reported by Garner and Gillingham (1998), describe

teachers who are pioneering ways and means for using the Internet in the classroom. They have undergone a shift from teacher-directed to learner-centered classroom practices infused with information and communication technology. Instructional strategies that foster learner-centered literacy activities are important according to Au and Raphael (2000): "Students with ownership understand the personal aspects of literacy, which leads to positive attitudes about literacy and habits of using literacy in everyday life for their own purposes. There is a reciprocal relationship between ownership of and proficiency with literacy" (p. 178). Many teachers are not prepared to use the Internet effectively in their classrooms in ways that empower their students to acquire the high levels of literacy skills they will need for their future life's work and opportunities. This study highlights the thinking of teachers and researchers who are on the forefront of using the Internet to enhance their students' literacy.

Researchers' Perspectives

When asked about the standards that provided the initial focus for the interviews, researchers interviewed for the study stressed that many conventional reading and writing skills are essential to using the Internet for research, publishing, and participating in online communities. Beyond those basics, two of the researchers interviewed cautioned that it is difficult to pinpoint a definitive list of necessary capabilities. One researcher noted that because technology is changing so fast, any list of skills prepared today might be shortly out of date. As an example, he mentioned the skills students now need to use email effectively—concise and careful writing skills, the ability to ask politely for information, the ability to create a positive environment for communication using the written word. But streaming video may change all of this in a few years. Therefore, he argued, the most important skill is to be able to adapt to new technologies and learn them quickly. Another suggested that there is little research documenting the essential skills of Internet use, noting that analysts are "doing a lot of guessing."

Overall, the researchers confirmed the following five themes in the literature that describe the benefits of using the Internet to foster students' literacy development.

Mastering Traditional Skills

Researchers agreed that uses of the Internet could help students master traditional reading and writing standards. Because students using the Internet have access to a real audience, one researcher suggested that they pay closer attention to grammar, spelling, style, and sentence structure. One respondent cited this example: Her students were working on a social studies project

Online Schooling Is Gaining Momentum

Concord Virtual High School

http://vhs.concord.org/home.htm

The Virtual High School (VHS) project is a grant-funded collaborative of 88 high schools from around the country. In exchange for contributing a small amount of teaching time, a school in the collaborative can offer its students NetCourses ranging from advanced academic courses to technical and specialized courses. Schools donate computers, Internet connectivity, and staff time. Each school also provides a VHS site coordinator who is responsible for project management and support of teachers and students at their local school. Each school can enroll up to 20 students for each course a teacher contributes. Quality of teaching is maintained by requiring each teacher to complete successfully The Teachers Learning Conference, a graduate-level NetCourse designed to give participants exposure to the best educational strategies and technologies for NetCourse teaching.

CyberSchool

http://www.cyberschool.k12.or.us/

CyberSchool is a consortium of public school institutions throughout the United States that have banded together to provide distance-learning opportunities for students via the Internet. When complete, it will be composed of one school district from each state in the United States and one or more comparable institution(s) in every country of the world. Consortium members will provide licensed teachers offering courses that can be taken by any student with reliable connections to the Internet. This consortium is currently made up of public school institutions in California, Idaho, Kansas, Michigan, Oregon, Ohio, and Wisconsin. CyberSchool's goal is to make it possible for any school to provide students a broad curriculum regardless of the school's size or location.

through which where they were communicating with a child in Brazil. At one point the Brazilian child said he had to go get a dictionary because he did not understand a word. When he could not find it, the American students realized they had misspelled it—a great lesson for them in the importance of spelling made possible by having an immediate audience for their writing.

Preparation for the New Workplace

Echoing the literature, one researcher described the changing "world of work" as placing new demands on workers to use technology to communicate effectively and to work collaboratively with others across time and space. He reasoned that since effective use of the Internet poses these same demands, Internet-based instruction could help students acquire valuable skills for the workplace.

Access to New Tools and Resources

The Internet in the classroom, converging with other digital technologies, offers students access to highly sophisticated tools to create and publish multimedia products—color, placement, video, etc. This access allows students to more effectively meet standards for research, writing, and publishing. In former times, these tools were not commonly available, and so the product that students produced could not be as sophisticated. The audience students can address through the Internet is much broader and more authentic. One researcher had been involved in placing original historical documents and photographs online for the Library of Congress (http://memory.loc.gov). This is one of many examples of how resources have become much more widely available to students with the advent of the Internet.

Tools for Collaboration and Exchange

Several researchers mentioned that the Internet offers unique opportunities for students to be active members of learning communities that ask meaningful questions and then debate various solutions. For this reason, social learning strategies of inquiry, analysis, critical reading, and communication all become more important. Interviewees stressed the value of collaboration and encouraged teachers to allow their students to build relationships with students in other classrooms in order to engage in joint projects, gather information, or share their reaction to a common reading. A few researchers suggested that it is especially valuable for students to communicate with their peers in other countries.

Tools for Exploration and Inquiry

Several of the researchers interviewed explained that the Internet should not be viewed as a packaged product for teaching literacy, but rather as a social environment where students can pose and answer genuine questions. One researcher mentioned that the best teachers are those who can develop highly social environments for their students. He offered several examples of Internet-based activities that require students to use higher-order thinking skills (see the Web sites listed under the Curricular Activities section of this report). In each case, teachers designed the assignments so students could individualize their learning and, at the same time, engage in social learning activities.

Teachers' Perspectives

The teachers interviewed and observed for this study cited numerous benefits to Internet use. Many suggested that engaging in Internet activities improves students' motivation and thus their ability to meet literacy standards. Several teachers believed that easier access to current information improves students' research skills, although one teacher cautioned that she was not certain that students' reading skills improve with Internet use because she noticed many students quickly flipping through pages without reading the text. Others mentioned that Internet research teaches students to evaluate sources more carefully and encourages them to work independently. Seconding the comments of one researcher interviewed for the study, several teachers noted that the ability to publish for a real audience improves students' writing skills. One teacher found that his students' work takes on a more mature "voice" when it is published on the Internet. Another stressed the value students can derive from having multiple "teachers" via the Internet.

In response to an open-ended question asking respondents to complete the sentence: "I began using the Internet in my teaching practices because..." (Question 3), the most common response was that it offered students more resources. Other common responses were that it offered students easier access to information, that it motivated students to perform at a higher level, and that it offered current information. In addition to these high-frequency responses, several other reasons were mentioned. The opportunity for global sharing, the fact that students would need Internet skills in the workplace, and the inservice training they had received were all factors that motivated some teachers.

Table 2

The survey asked respondents: "Based on your experience with Internet-based learning activities, rate each statement below according to *how often you observe its benefit* occurring for your students."

Rank order of important or very important observed benefits for students	***Mean*** n=56
Expands the variety of resources available	4.6
Hones technology skills	4.4
Promotes active student reading	4.3
Enhances collaborative discussions	4.1
Facilitates authentic, real-life literacy experiences	4.1
Enhances understanding of content	4.1
Makes reading enjoyable	4.1
Fosters use of critical reading skills	4.1
Facilitates reading fluency	4.1
Provides accurate information resources	4.0
Customizes reading experiences for students	4.0

Teachers who answered the survey observed most often that using the Internet benefits students by expanding the variety of resources available to them. Students also benefit very often by honing their technology skills and engaging in active reading. According to these teachers, benefits of using the Internet also include facilitating fluency, fostering critical reading, and enhancing understanding of the content. The processes involved in using the Internet that teachers often or very often observed as beneficial include collaborative discussions and authentic real-life literacy experiences. In addition, teachers said using the Internet customizes reading experiences for students. Teachers also often observed that, along with these benefits, Internet-based learning activities make reading enjoyable for students. These characteristics of engagement are instrumental in helping students in their reading development, according to Au and Raphael (2000).

Individual teachers also mentioned that the Internet shifts responsibility for learning to the student, and that it offers access to experts. A special education teacher noted that Internet activities were effective with special learners.

In completing the open-ended sentence: "I have observed that the Internet affects students' reading and writing skills in the following ways..." (Question 4), respondents mentioned motivating students more often, inducing students to write more effectively, helping students improve reading, providing an authentic audience, and developing students' critical abilities to analyze sites. Other responses included allowing students to produce a more polished product and teaching audience awareness.

All in all, the participants in this study held a common understanding about the benefits that using the Internet provides students. Central to these benefits are several curricular activities students engage in and the instructional practices of their teachers. The curricular activities commonly used by these teachers to enhance students' literacy development fall into three categories: researching information, participating in online learning communities, and electronic writing and Web publishing.

Curricular Activities and Related Standards

Literature Review

Systemic reform initiatives point toward the need to combine content area learning and technology standards with reform initiatives favorable to learning. At the organizational level, the school community's efforts to meet technology goals stems from providing the conditions conducive to digital learning. "Digital learning is the educational approach that integrates technology, connectivity, content and human resources. When implemented correctly, it builds on the unique, dynamic characteristics of digital content to create productive and engaging learning environments" (CEO Forum, June 2000, p. 7). Digital learning is linked closely to digital literacy. "Digital literacy is the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (Gilster, 2000, p. 215). Seamless integration of word processing, hypermedia authoring tools, and telecommunications through the Internet facilitates and supports digital literacy on many levels.

Telecommunications and the Internet provide access to emerging disciplinary and interdisciplinary databases of information, real-time phenomena, and social communities not accessible through print-based curricula (CTGV, 1997; Riel and Harasim, 1994; Romiszowski, 1997). The complex reading and writing tasks involved in Internet-based reading and writing require students to apply knowledge of media grammars, current social literary conventions, and information literacy skills to creating and sharing nonprint texts with teachers, peers, and authentic audiences outside the classroom. The NCTE/IRA standards for the English language arts, when taken holistically, acknowledge the influence of information and communication technologies on the English language arts skills that twenty-first century students need to acquire. For this study, concepts from the student standards listed in the "Methods" section (NCTE/IRA, 1996) were incorporated into questions asked in interviews and in the online survey. The sidebar on page 10 highlights our findings from researchers and teachers about using the Internet to support three types of curricular activities.

Information Research on the Internet

Literature Review

Very little research has been conducted regarding the reading processes involved in reading electronic texts (Kamil & Intrator, 1997; Reinking & Bridwell-Bowles, 1996). In fact, "the proportion of research articles published on technology and literacy remained relatively constant over 11 years [between 1986-96]" (p. 394) in disproportion to the investment in technology resources, according to a trend analysis conducted by Kamil and Intrator (1997). Research in this area is difficult given the wide range of media characteristics and lack of standard literary conventions applied to the authoring of electronic texts. Existing research findings about reading hypermedia (a technical term that refers to multimedia hypertext) are mixed. Heller (1990) reviewed early studies conducted on the role of hypermedia in education. The literature indicated problems of disorientation, cognitive overload, flagging commitment, and unmotivated rambling among readers of hypermedia texts. Similar problems also may occur when using the Internet. Heller identified a browsing strategy characterized by following links perceived to be relevant as ineffective for novice hypertext or hypermedia information researchers. Novices may be unable "to formulate a search objective and thereby be unable to take advantage of the richness of the [hypermedia] system" (Heller, 1990, p. 433).

These findings from early digital content research suggest the need for specific skills for using Internet search engines. Search engines are used by about 85 percent of users to locate information; several search engines consistently rank among the top 10 sites accessed on the Web (Lawrence & Giles, 1999). "The Internet and the Web are transforming society, and the search engines are an important part of this process" (Lawrence & Giles, 1999, p. 107). In 1999, six major public search engines (Alta Vista, Excite, HotBot, Infoseek, Lycos, and Northern Light) collectively captured only 60 percent of the information available on the Web. Studies indicate that Web coverage by any one search engine is extremely limited; combining search results of the above six search engines rather than using a single search engine can increase search capacity by 3.5 times (Lawrence & Giles, 1998). The implications of the ever-increasing reservoir of Web-based resources and the complexity of navigating those resources for teachers are unknown. Yet most children

America Dreams Through the Decades: Teaching Page

http://memory.loc.gov/ammem/ndlpedu/lesson97/dream/teach.html

America Dreams Through the Decades is an interdisciplinary Internet project designed to use digitized primary-source documents from the "American Memory" collection available on the Web site. This project, for upper-elementary, middle, and high school classes, invites teachers and students to sift through a vast collection of rare print documents, early motion pictures, numerous collections of rare prints and photographs, and recorded sound collection right from the classroom. American Dreams could be a yearlong theme for American history and literature in a high school setting, while in middle grades, it could be a four- to five-week interdisciplinary unit focusing on, for example, immigration at the Turn of the Century. For classes participating in the extended online collaborative project, two to three weeks might be spent with this historical WebQuest before turning student attention to the present and then to the future. The flexibility inherent in this project will allow teachers to adapt the project to their students' needs.

Ms. Smith's English Page

http://home.earthlink.net/~jesmith/

Weymouth Junior High English teacher Janice E. Smith designed this Web site. It contains links to information used by Smith to teach her literature and writing classes. Included are links to novel notes, grammar resources, writing resources, Internet info, and other English teachers' Web sites, as well as links to student work, a parents' page, and a "recommended books" section.

Mr. Heffner's Web Site

http://www.pipeline.com/~sheffner/classroom.html

Conrad Weiser High School English Teacher Steven Heffner designed this Web site. It contains links to information used by Smith to teach his ninth-grade English and journalism classes. Included are links to course information, a study-hall chat room, student progress reports, curriculum resources, course requirements, an extra-credit page, online writing style guides, and I-search paper resources.

Ms. Hos-McGrane's Grades 5 and 6 Student Projects Web Site

http://www.xs4all.nl/~swanson/origins/intro.html

This Web site began with a series of joint projects between two teachers in March 1996, when both were working at the International School of Amsterdam. One of the teachers had access to HTML authoring shareware and server space through her personal dial-up Internet account. The other, a Grade 6 teacher, had undertaken a number of curriculum projects with her class and was interested in having the students learn about online publishing, presentation and, of course, using the Internet and the World Wide Web. During the next few years, these two teachers posted a number of the students' projects to the Web site, which now features almost 30 projects as well as links to additional curriculum materials maintained in Amsterdam and California.

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are taught how to use Internet search engines at school. Correlations have been drawn between the specific skill of being able to use Web search engines and teacher and student use of the Internet (Becker, 1999).

Researchers' Perspectives

Beyond the most basic skills involved in Internet research, such as using search engines to devise effective keyword searches, researchers interviewed for this study listed other higher-level capabilities students need. One researcher pointed out that before students can begin making queries on the Internet, they must have fundamental library skills: Without an understanding of sources, students are overwhelmed by the information available online. Another researcher emphasized that students need metacognitive, knowledge-building skills. They must be able to reason aloud how to go about finding and judging information, and they must recognize the biases they have that will influence their search. Another researcher also noted the importance of being able to access the online environment—recognizing conventions such as how Web pages are structured with links, advertisements, and icons.

Researchers consulted for this study also focused on how teachers could help students learn two particular Internet-research skills: how to conduct searches, and how to evaluate sources. The majority of the researchers favor a "scaffolding" approach to teaching students how to search on the Internet—providing students with fundamental support before throwing them into the online environment. Most felt that, particularly in the lower grades, it is important to conduct a pre-search in order to give students some guidance in their query. However, the interviewees also noted that the ultimate goal is for students to be able to negotiate the Web on their own. In a similar vein, one researcher suggested a strategy of experimentation. She encourages teachers to allow students to discover what happens if they enter a general keyword such as "snakes" and then see how the search result differs after refining the query. In addition, researchers agreed that teaching students to evaluate sources is both extremely important and difficult to accomplish. One researcher proposed having students develop a list of criteria to apply to different Web sites. Another recommended a new chat program that attaches to the bottom of any site and allows students to discuss the site's content and presentation.

Teachers' Perspectives

The teachers interviewed and observed in this research provided a long list of skills students need to conduct Internet research well. Some mentioned the importance of beginning with a good guiding question to help students stay focused when faced with the volume of information available on the Internet. Several cited such technical skills as navigating site maps, using the "find" function, and conducting a keyword search using a search engine. Others mentioned such analytical skills as choosing an appropriate search tool, sorting through large amounts of information quickly, organizing a large volume of information, determining the validity of a site, and recognizing the pertinence of information. Many were concerned that students be able to develop a bibliography accurately. The skills mentioned by teachers in the interviews were incorporated into the online survey: Table 2 shows how another 56 teachers ranked these skills.

Because most teachers interviewed for this study use the Internet primarily as a research tool, they had many ideas about how to teach online research skills. Most agreed with the researchers that conducting a pre-search was important, particularly in the early grades or at the beginning of the school year. Several also favored using an overhead projector to demonstrate how to refine a keyword search, use links and a site map, use the "back" and "find" functions, and cut and paste information into a word-processing document. Others mentioned teaching students by demonstrating how to use different search engines and how to bookmark important sites. One teacher observed for the study spent 10 minutes at the beginning of class using an overhead projector to show her fifth-grade students how to sift through the information on a sample Web site similar to one they would be using to collect information about an invention. She pointed out advertisements, links, and the additional facts listed at the bottom of the page.

To help students learn to evaluate sources accessed online, several teachers lead their students to hoax sites. Others emphasize the difference between commercial and noncommercial sites by discussing dot-com, dot-org, and dot-gov domain names. One teacher requires his students to find information from at least two sources before using it, while another believes that having students present their final work to the class and explain their choices helps them reflect on the

Table 3

The survey asked respondents: "Rate the *level of importance* you think each of the following skills plays in students' effective use of the Internet."

Rank order of important or very important skills	***Mean*** n = 56
Recognizing how pertinent information is to a topic	4.6
Understanding the bias of any Web resource	4.5
Organizing a research question before beginning to gather information	4.5
Using search engines to identify sources relevant to a topic	4.5
Staying focused on the topic	4.4
Presenting electronic information succinctly	4.3
Organizing large volumes of information about a topic	4.3
Categorizing information on a topic	4.3
Assessing the reputation of a Web site's publisher	4.2
Using Web conventions such as text links, site maps, or bookmarked Web addresses to navigate	4.1

Teachers responded that the most important skill for students is recognizing the pertinence of information found on the Web. The next grouping of important skills focuses on staying focused on a research question, using search engines to identify the sources to help answer the question, and understanding resource bias while doing an Internet search. Teachers also indicated that it is important to have skills to deal with volumes of information on the Web when researching. These include being able to organize and categorize the information on a topic, present it succinctly, and assess the resources that one is organizing and categorizing. Using Web conventions to conduct Web research is also an important "language rule" to understand.

search process. Most of the teachers interviewed agreed that a significant challenge is teaching students to record Web bibliographic information accurately. During an observation of an eleventh-grade class beginning a weeklong research project, it was apparent that many students were not taking the time to record their Web sources as they collected information, despite the teacher's reminders to do so. Several teachers worried about students' tendency to plagiarize, raising the importance of explicitly discussing ethical issues when engaging in Internet-based curricular activities.

Participating in Online Learning Communities

Literature Review

The National Research Council has declared, "It is no longer hyperbole to suggest that telecommunications has the potential to change the way teachers and students interact, communicate, and learn from one another" (Blanchard, 1996, p. 320). The Internet has the potential to be an important tool for students to use in reaching their learning goals. Among the primary goals of the composition curriculum in the upper grades has been to introduce students to the discourse communities of the culture and academia, and to enable them to partake in these communities (Balester, Halasek & Peterson, 1992; Hawisher, 1990; Probst, 1990).

Mini-Classroom Case: Discovering History Through Internet-Based Research

Kim Bigham-Dirck and Lisa Schell, team teaching an American Studies course for college-bound students at West Aurora High School in Illinois, developed a yearlong research project asking students to investigate events and people not included in their textbook. In order to understand an America that includes a multitude of viewpoints, many nationalities, and both genders, students gathered information on the Internet about specific influential people. They then published their findings on the school's Web page. For the courses' first three historical time periods (Revolutionary War, Romanticism, and Antebellum), the teachers give students a specific person to research and URL addresses to use. Students are required to gather specific types of information for their Web pages, but the goal is for students to be able to conduct searches independently. In addition to providing facts about the individual's role in history, students must find an image, a quotation, and a song title to incorporate on the Web page. For extra credit, students can create an illustration or a political cartoon, or write a diary entry in the voice of the historical figure to further enhance the Web page. As they conduct their inquiry, students learn to cut and paste relevant information into a research file, and to identify correctly all their sources. They also reflect in writing on their search process and explain why they decided to include or not include specific information. In completing this assignment, students meet the English language arts standards for research that refers to their ability to gather, synthesize, and communicate information from a variety of sources.

Nonacademic forms of literacy also play a role in how preteens and teens establish and maintain group affiliations (Finders, 1997). Research on computer-mediated communication patterns shows a difference from verbal face-to-face communication patterns found in pre-computer disciplinary discourse about information (Geisler, 1994; Cognitive and Technology Group at Vanderbilt, 1997; Riel & Harasim, 1994). The role of the teacher also changes (Cognition and Technology Group at Vanderbilt, 1997; Riel & Harasim, 1994). In online discourse communities, discussions often focus on analyzing, questioning, debating, and generating disciplinary knowledge through collaborative writing activities with professionals. These online communications can greatly enhance the perspectives and thought processes that challenge students engaging in literacy learning events.

The number of online communication tools and groups is growing exponentially along with the market of Web-based resources available online from the public and private sectors. In addition, although gaining Internet skills will give students access to valuable information and discourse groups, a typing error or innocent information disclosure can open doors to trouble. Research conducted by computer-crime specialists shows that criminals have easy access to children through online chat rooms and regularly interact with kids online in order to lure them into unsafe relationships (Federal Bureau of Investigation, 2000). The organization, or lack thereof, of resources and communicants on the Web requires time and expertise on the part of the user.

Researchers' Perspectives

The complicated nature of online communication was reflected in the comments of both researchers and teachers interviewed. Although several interviewees mentioned the importance of fundamental writing skills—clarity of expression, grammar, and spelling—they also felt that communicating online poses unique challenges.

Some researchers noted that students must understand the appropriate formality of a situation in order to create a positive online relationship, particularly when they are asking for information or responding critically to another person's work. One researcher said that it is important that students be able to compare their questions with the information they receive and refine their

questions if necessary. One researcher described a technique used to involve students in an online learning community. (See the Mini-Classroom Case on Virtual Travel to Ancient Rome.)

Teachers' Perspectives

Like many of the survey respondents, most of the teachers interviewed did not have experience allowing their students to participate in online communities. This was because either their schools' acceptable-use policies do not allow students to have email accounts or participate in chat rooms, or because they had never explored this possibility and preferred to use the Internet as a research and publishing tool. Among those who do allow their students to use email, some teachers mentioned that students need to be aware of the difficulty in conveying emotions online, and that they must be able to add detail when asked for clarification.

In addition, teachers echoed researchers' comments about the importance of understanding the audience and adopting an appropriate level of formality given the context. Because most teachers interviewed did not have their students participate in online communities, very few were able to comment on how to teach students these skills.

Electronic Writing and Web Publishing

Literature Review

The other side of the Internet-based research coin is Web publishing. The volume and variety of content generated within and accessible through the Internet far exceed the amount and variety of content embodied in print-based curriculums located in school settings. The Internet is making it possible to circumvent the three- to five-year information publishing cycle of the print-based industry. Information technologies provide students with interactive, open-ended tools for constructing and presenting meaningful information resources to others. These tools include database and word processing programs, electronic hypertext and multimedia authoring tools, programming tools, and networked groupware that adds to the increasing volumes of content that learners encounter. Early predictions suggested that the Internet would expand by 1,000 percent during the next few years (Barrie & Presti, 1996). The number of public Web sites actually tripled between June 1997 and June 1999 (Online Computer Library Center, June 1999). These numerous

Mini-Classroom Case: Virtual Travel to Ancient Rome

Bonnie Thurber, a training and support specialist and former classroom teacher from Illinois, designed a lesson in which sixth- and seventh-grade students took on roles within a virtual environment. She created a MUSH site and asked students to role-play at being a citizen of Ancient Rome. Using the Internet, students assumed a role and designed a virtual room or dwelling to fit their personage.

Students not only learned about the history and culture of Ancient Rome, they also became part of an online learning community. In the process of researching their role, students made contact via email with contemporaries in Roman classrooms and asked the Italian students to critique their virtual rooms, posing such questions as: Were they correctly placed geographically? Did they include the right objects? Were they historically accurate?

Students were exposed to the complexity of communicating online when they had to refine their questions after initially not getting the desired information. They also learned to access and gather information from Web sites that the teacher had pre-selected. In completing this project, students met the English language arts standards that refer to student's ability to conduct research, as well as their ability to participate as reflective members of a variety of literacy communities. According to the designer, it was the real-audience aspect of the project, as well as the opportunity to take on a different identity, that made the project a success.

Web resources contain a vast variety of up-to-date information for almost every academic discipline. However, a June 1999 study conducted by the Online Computer Library Center reported that significant portions of the Web do not offer meaningfully organized content. The complexity of Web publishing constitutes its strength and characterizes its weakness for teachers and students involved in literacy learning.

In an early 1990s study, eighth-grade students with high-level keyboarding skills and online text manipulation abilities scored significantly higher on standardized

writing assessment measures than when they lacked those skills and abilities (Owston, Murphy, & Wideman, 1992, p. 268). Owston and his colleagues concluded that online text manipulation abilities are important prerequisite skills for electronic writing tasks. Students who lack these skills may experience a heavier cognitive load than when they use paper-and-pen writing methods (Owston, Murphy, Wideman, 1992, p. 250). This contradicts the once-popular belief that word processing automatically lightens the cognitive load on students (Joram, Woodruff, Bryson, & Lindsay, 1992).

More recent case studies conducted by Garner and Gillingham (1998), cited teachers' purposes for using the Internet according to the following literacy learning benefits to their students: (1) expanding uses of written language when corresponding with distant readers and monitoring their own written communication for coherence, ambiguity, and grammar; (2) learning to converse, compose, and comprehend their native second language; (3) improving English-language fluency through increased unity of expression, grammatical correctness, and mechanics; (4) generating powerful persuasive essays with evidence on topics of personal interest; (5) establishing the occasion, audience, and topic for engaging in online discussions; (6) engaging in literature-based learning and gaining an understanding of authorship. Students in the case studies published their findings and arguments by sharing them with distant readers, who wrote back via the Internet.

Researchers' Perspectives

A common theme about Web publishing among researchers interviewed in this study was the importance of an awareness of responsibility. As one researcher said, students need to be aware of the impact they have on others and take their work seriously, not just in terms of proper use of grammar, spelling, and usage, but also in terms of audience awareness. Students need to be sensitive to the level of formality needed given the context, and they need to be aware that humor can be misunderstood. One researcher stressed the dynamic nature of Web publishing: She believes that Web publishing should be a social process and that students should learn to solicit and incorporate the comments of others. Another researcher commented that students need media literacy skills: They should understand that images can be persuasive and so be able to combine text, graphics, and sound in engaging and compelling ways.

Teachers' Perspectives

Interviews with teachers yielded a list of specific technical and organizational skills that they feel students should learn in order to design effective Web pages. Several mentioned basic writing and typing skills as a foundation for publishing on the Web. In addition, teachers mentioned skills specific to online publishing: An ability to map and outline information as part to the design process was cited as an important skill, as was the ability to integrate images with text and to use artistry in integrating font, color, and graphics effectively. Understanding and judiciously placing links was mentioned, as was the need to present information succinctly. One teacher uses the rule that Web page text should be half the length that it would be if appearing in paper form. As a final note, a few teachers mentioned the importance of student collaboration in producing Web content, in terms of both actual production and participating in a peer-review process.

Researchers and teachers agreed about the value of group-publishing projects in which students contribute to one another's knowledge about a topic. Many teachers assign group projects and allow students to pick roles within the group. They stress that each group should map and outline their Web page in order to present information in an organized and effective way. Teachers also encourage students to use peer review as an editing tool.

During one observation, tenth-grade students were assigned to groups with each member determining what role he or she would play in putting together a Web page about a historical figure. Two students chose to research written information, another collected images, and the fourth student wrote the content for the page. As a context for the publishing activity, teachers stress that students are exposing their work to a real audience. One teacher prepares her students by having them analyze the design and content features of existing Web sites. The students use the criteria they developed as critics to then judge their own products.

Mini-Classroom Case: Rising to the Challenges of Web Publishing

Susan Latour, a former high school English teacher from Virginia, designed a lesson in which she asked eleventh-grade students to publish a page on the school's Web site analyzing themes and ideas from the Ralph Ellison novel *Invisible Man*. During the school year that this four-week project was assigned, students were taught to write and design Web pages using HTML.

According to the teacher, students embraced the project and created pages that far surpassed her initial expectations. Each student chose a chapter and was responsible for summarizing, analyzing, and identifying significant quotations from that chapter. Students searched the Internet, located graphics, scanned images, and created a detailed bibliography with links to pertinent sites. In doing so, students met the state language arts standards for research as well as the standards that ask students to demonstrate competence in reading a variety of texts and to communicate their discoveries in ways that suit their audience.

At the conclusion of the project, students worked in teams to critique and edit one another's work. They then presented their Web pages on a Panasonic LCD projector. Student's comments about their content and design choices revealed a sophisticated understanding of the novel. Their work was assessed on their ability to organize information, the quality of their analysis, the depth of information they gathered, and the inclusion of pertinent links.

Related Instructional Strategies

Literature Review

In *How People Learn*, Bransford, Brown, and Cocking (1999) explore technology's potential to provide five key conditions that research indicates enhance learning. The conditions include: offering a real-world context, connecting to outside experts, providing for visualization and analysis, scaffolding problem-solving, and presenting opportunities for feedback, reflection, and revision. Romiszowski (1997) traced connections between telecommunication systems and educational reform philosophies, leading to an emphasis on learner-centered approaches. The literature is steeped in calls for professional development of teachers in learner-centered practices that can align uses of the Internet with systemic reform initiatives.

Garner and Gillingham (1998) looked at teachers who had been included in their case studies about the Internet in the classroom and found they were changing their instructional practices to be more learner-centered. One major shift involved students becoming more knowledgeable about the topic under investigation than the teacher. The result was students providing information to the teacher and the teacher listening and learning about the topic. The students and teachers found themselves grappling with the complexity of competing perspectives and conflicting facts found on the Internet, as opposed to fixed facts and single source perspectives found in many textbooks. In this regard, Internet-based curricular activities challenged teachers to provide students with skills needed to evaluate accounts. These skills include the ability to assess reasons for existing bias and to identify corroborative detail across accounts. Garner and Gillingham concluded that the extent to which students use the Internet as a tool for literacy learning remains largely dependent on the teachers' instructional practices.

As instructional and curricular changes occur within the classroom, assessment changes are called for as well. It is vital for school community leaders to identify and select newer standardized tests that fit appropriately with the school community's learning goals and that measure the effects of the technologies used. Linn, Baker, and Dunbar (1991) suggest that alternative forms of assessments need to provide a basis for evaluating students' content quality as well as comprehensiveness of content coverage, the degree to which per-

formance on specific assessment tasks transfers to additional tasks, the cognitive complexity of students' processes for solving meaningful problems, and intended as well as unintended consequences of the learning process. In addition, alternative assessment may be more suitable for conducting meaningful research about relationships between technology and student achievement (*Pathways to School Improvement Critical Issue: Using Technology to Improve Student Achievement*, 1999). Leu and Kinzer (2000) predict that literacy assessments will soon include measuring one's ability to adapt to technological changes and to use technologies for information and communication purposes.

The learner-center principles (see http://www.apa.org/ed/lcp.html) set the standards for systemic reform initiatives and are embedded within the new NETS for Teachers (ISTE, 2000). Teachers who achieve these standards are able to maximize the return on technology investments. Their practices focus on designing, implementing, and assessing students' digital learning. "Now, literacy instruction at all levels—pre-K through college—means incorporating a much more authentic and learner-centered approach. In the future, with the aid of interactive, multimedia technologies, it will come to mean even more learner-based instruction, with learners controlling their own destinations to achieving their goals" (Leu & Kinzer, 2000, p. 123). Implementation of the Internet in schools challenges teachers to develop new teaching processes and methodologies that apply learner-centered strategies. The following sections highlight our findings from researchers and teachers about the instructional strategies used to conduct the Internet-based curricular activities.

Researchers' Perspectives

Researchers interviewed for this project noted a number of interesting differences and similarities between Internet- and print-based instruction of reading and writing. Many of these related to the skills students need to use the Internet effectively, discussed above, or the changing role of the teacher during an Internet-based activity. But some of the teachers' more general comments are also worth noting. One pointed out that when students use the vast information resources of the Internet, teachers often will be in a position of knowing less about a topic than their students—a situation which can be disconcerting and which requires teachers to think about their roles differently. Nevertheless, the teacher still must guide and inspire students.

According to another researcher, the largest shift underway has to do with moving away from the idea that it is important to get as much information into students as possible by packaging the information into bundles they can learn, such as textbooks. Instead, students now must sort through multiple sources of information for themselves. With the explosion of information, teachers must teach students to evaluate information on their own. Traditional literacy programs, she says, focus on teaching kids to enjoy reading rather than to read in different ways for different purposes, which is much more possible with the multitude of resources available online. One researcher stressed the magnitude of the change in instructional practices that is required for effective Internet use. In schools that are not thoughtful about this shift, the Internet gets "bracketed" as a special-purpose tool or an activity for computer class, and so it is not used in the best ways across the curriculum.

Researchers offered several pieces of advice on successfully planning Internet-based activities for the classroom. One researcher stressed the importance of teachers' conducting pre-searches of the Internet, especially for less experienced students. Since filtering and judging is so important, this kind of preparation can make Internet use much more productive for students. Two of the researchers emphasized that teachers should not aim to create "packaged instruction." Since the Internet is a "pull technology" rather than a "push technology," teachers should aim to develop an environment in their classrooms that encourages and facilitates exploration. By asking students to pose their own problems, develop theories, collect information, and build understanding as a community, teachers make the most of the Internet's possibilities. Although researchers often expressed the value of the Internet as a tool for collaboration, one argued that students also need individual online time to explore on their own. Teachers need to structure time for such exploration. One researcher also urged teachers to teach parents how they can reinforce at home the importance of using the Internet responsibly, judging content astutely, and so on.

Researchers interviewed also noted that teachers play several roles in effective Internet-based instruction. Since much Internet learning is self-directed, the teacher's role changes to one of support and facilitation. As one respondent rhymed, the teacher serves as "a guide on the side, not a sage of the stage." Rather than dispensing information, the teacher becomes an expert learner alongside students in the classroom.

Adopting such a role, said one researcher, requires an underlying philosophy of learning that encourages inquiry. At the same time, teachers should not lose sight of their role as "guide"—even when students may be more technically proficient in some ways. This facilitator-guide role, one researcher noted, adds "enormous complexity" for teachers. While they must ensure that students remain safe, teachers make the most of the Internet when they expose them to different sources of information, researchers said. Organizing information in "manageable chunks," particularly for lower grades, is also an important teacher function, according to the researchers. Without such organization, one researcher remarked, the incredible power of the Internet can be overwhelming.

When it comes to assessing students' Internet-based learning activities, the researchers interviewed in this study agreed that Internet-based learning creates new assessment challenges. In some respects, one suggested, the assessment challenge is the same as with any instructional approach—most important is having a clear understanding of the essential skills being taught. They said approaches to assessment should follow logically from that desired endpoint. Assessment, another researcher noted, should be very clear to students—they always should understand the goals of an assignment. But defining these goals or endpoints presents complications. One researcher asked: Do you evaluate where students went online, or what information they gathered? Do you penalize the person who explores and doesn't gather as much written information, or the person who stays with an initial page and finds lots of written information? In addition, since these researchers believe the skills required for effective use of the Internet differ in some ways from traditional skills, new assessments must be devised to track students' mastery of these new capabilities.

In particular, the researchers suggested that it is important for teachers to assess:

- How well students work in teams
- How well students communicate and transfer information to others
- How much time it takes students to find information
- How well students adapt to new technologies
- How well students examine sources and information critically

Researchers offered some ideas for assessing these capabilities. For example, one researcher suggested giving students a new email program to work with in order to test their adaptability to new technologies. Another said that having students present their work and defend their research choices and revisions can be a means of assessing students' examination of sources and their critical thinking skills.

Teachers' Perspectives

Teachers interviewed for the project echoed many of the researchers' comments about the differences in instruction brought about by the Internet. Some pointed out that in Internet-based instruction, students have more control over the learning process. As a result, these teachers place less focus on conveying specific content and more on teaching problem-solving skills. As one respondent said, "I sometimes feel I am not really teaching." Another remarked that Internet-based activities "put me on a more equal level with students who are pursuing more individualized assignments." Others reported engaging in more intense conversations with students about their learning, spending more time serving as a "coach," and having the flexibility to individualize instruction.

Teachers interviewed for the study cited a number of factors that help them determine when to use the Internet for instruction, including:

- The availability and depth of material available on the Internet on a given topic
- How engaging the available Internet-based material is to students
- How appropriate the material is to students' reading levels
- How efficiently students can complete an activity online, compared to other approaches
- The technical skills of the students
- The access students have to computers and the quality of Internet connections

Teachers interviewed for this report offered some practical suggestions for planning. They urged their peers to determine what skills they wanted students to learn in the activities, design handouts that give clear directions on the activities, conduct a pre-search or build a site that gives students appropriate links or an online model that will guide students through assignment.

They also said teachers should do assignments themselves first to determine how much time they require.

Teachers cited several examples of their new roles during Internet activities, including leading students through a sample assignment by projecting the teacher's screen onto the wall, walking around the room offering assistance with student questions, looking in on student work through the teacher's computer, and asking individual students to reflect on their work-in-progress. Some teachers mentioned that although they would like to be able to sit down and work with individual students, they did not have the time because so many students need their assistance. During all of the observations for this study, teachers spent the majority of their time walking around the room briefly answering student questions about process and technical aspects of their work. Most of the time, two or three students waiting with hands raised as the teacher quickly answered another student's question.

According to one of the teachers we observed, Internet-based instruction is physically and mentally demanding. One possible explanation of the demand is the finding from both researchers and teacher interviews that Internet-based instruction individualizes student learning. Researchers stressed that teachers have a responsibility to ensure that all students learn from the Internet-based activities they deploy. This responsibility is especially critical with what one researcher called "monastic learners," those who do well in an environment in which everyone does his or her own work and needs not interact socially to get information.

Teachers interviewed and observed in this study pointed out a variety of ways in which they use the Internet to individualize instruction. They noted working with students one-on-one on projects, providing students with individual assignments, assigning group projects in which students choose their roles, modifying assignments for different levels of students, and designing open-ended assignments that allow students to pursue individual interests. One teacher handed an index card to each of her fourth-grade students and asked them to complete one of three activities listed that were designed to teach them to use an online thesaurus. Without explicitly saying that the assignments were at different levels, she was able to individualize the assignment so that each student worked at an appropriate level.

Interviewed teachers also offered a list of capabilities they find important to assess in Internet-based instruction. In addition to echoing many of the researchers' points, teachers noted the value of assessing the depth of the information students obtain, the quality of their written product, their ability to meet deadlines, and their ability to reflect on the process in a journal. One teacher also noted that in the spirit of the Internet's collaborative features, peer review, and comments from the public are important assessment tools for teachers to consider.

We asked surveyed respondents about these findings from the interviews related to instructional practices for the Internet-based curricular activities. The survey respondents indicated the following:

- Their most cited criteria for deciding when the Internet is the appropriate tools are scope of available resources (50), nature of available resources (49), and efficiency of completing a learning activity (48), based on responses to Question 11.
- The two activities teachers said they engage in the most when planning Internet-based writing and/or reading activities are conducting a pre-search to help guide students in their inquiry (49) and designing assignments that allow students to pursue individual interests (50), based on responses to Question 13.
- Their primary roles during Internet-based activities are offering assistance with student questions (53), assessing individual students' skills (52) and modifying assignments to meet the needs of diverse learners (50), based on responses to Question 15.
- The four most prominent ways they assess students' effective use of the Internet involve students' ability to read text accurately (42), compare and contrast information sources (47), synthesize multiple sources on a topic (43), and organize information elements into a new and meaningful structure (44), based on responses to Question 17.

These survey results confirm points made by those interviewed while also assigning more importance to the instructional practices cited most often by respondents.

Professional Development of Teachers

Literature Review

With almost all schools and more than 63 percent of classrooms in America currently connected to the Internet, using it for literacy instruction is becoming more and more feasible. It also is warranted, according to Leu and Kinzer (2000), who state: "We worry that those of us who have developed our research careers around the book may be the last to respond to the fundamental changes taking place in our world. To continue to ignore these changes will severely limit our ability to support teachers and children on their important journeys" (p. 125).

An essential condition that greatly influences how the Internet is used for student learning resides in teaching practices. Virtually all teachers involved in implementing technology can benefit from valid and reliable feedback about their teaching practices. Typical sources of evidence collected by schools include data about teacher technology competencies and teacher beliefs about technology. However, much more is needed to inform teachers' individual professional development planning. "If we want to develop a community of learners—where students naturally seek feedback and critique their own work—then it is reasonable that teachers would model this same commitment to using data systemically as it applies to their own role in the teaching and learning process" (Shepard, 2000, p. 21). Whatever type of evidence the focus of the evaluation calls for, teachers who can engage in action research and acquire new assessment design and data analysis skills will be equipped to confront the many unknowns that arise when technology influences change in teaching practices (Wood & McQuarrie, 1999).

Teachers who participate in a professional learning community often engage in reflection and debate about the impacts technology can have on their teaching practices and their students' learning (Shapiro & Levine, 1999). Online collaboration tools, known as groupware, can foster correspondence among teachers and collaborative curriculum design. In addition, groupware used by professional development learning communities can be used to capture both dialogue and products produced by teachers for later analysis among members of the professional community for evaluation purposes. Electronic discussion lists, Web sites, and electronic newsletters represent additional ways to share information about instructional practices among teachers involved in professional development initiatives (Shapiro & Levine, 1999). The sidebar highlights our findings from researchers and teachers about the professional development teachers need to effectively implement uses of the Internet for students' literacy learning.

Researchers' Perspectives

The researchers interviewed for this study diverged in their views of how formal preparation programs can help prepare teachers to use the Internet effectively. One researcher argued that universities teach preservice teachers to use technology but not how to integrate technology into their classes—they do not teach preservice teachers by actually using technology. Instead of taking required technology classes, one researcher recommended, preservice teachers should have technology integrated into their subject and methods courses, so they gain exposure to innovations like core subject Web sites, online critical thinking activities, pen pal activities, and audience-awareness exercises in their training. Such exposure will familiarize them with the possibilities and help them make sense of their options.

Another researcher, by contrast, stressed the importance of teacher candidates' mastering basic Internet skills, such as participating in a chat room, using email, and conducting online searches. If they are exposed to these activities often enough, this researcher said, teachers will gain confidence. Requiring mastery of these basic skills of all preservice teachers would help ensure that exposure.

A third researcher was more skeptical of whether current preservice programs were the best places for candidates to learn these capabilities. Existing preservice faculty are often not prepared themselves to train teachers in these new areas; they are comfortable with books. Therefore, this researcher argued, teachers can learn best from other teachers—from going online and finding teachers doing innovative learning projects on the Internet.

One researcher interviewed for this report cautioned that forcing teachers to use the Internet will not work. Training has to happen slowly, one step at a time. Administrators should be supportive, this researcher suggested, and give teachers credit for what they are

Researcher Recommended Internet-Based Professional Development Activities

The Jason Project

http://www.jasonproject.org/

After discovering the wreck of the RMS Titanic, world-famous explorer and oceanographer Dr. Robert Ballard received thousands of letters from students around the world wanting to go with him on his next expedition. In order to bring the thrill of discovery to millions of students worldwide, Dr. Ballard founded the JASON Project, a year-round scientific expedition designed to excite and engage students in science and technology and to provide professional development and motivation for teachers. The JASON Project is a hands-on, inquiry-based learning experience providing fourth- to ninth-grade students and their teachers a comprehensive, yearlong, multimedia program based on the National Science and Geography Standards. The project is designed to enhance teaching and learning in science, technology, math, geography, and language arts. It integrates an award-winning curriculum, video programming, satellite transmissions, and online activities.

The WebQuest Web Site

http://edweb.sdsu.edu/webquest/webquest.html

This site is designed to serve as a resource to those who are using the WebQuest model to teach with the Web. By pointing to excellent examples and collecting materials developed to communicate the idea, all teachers experimenting with WebQuests are able to learn from one another. A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis, and evaluation. In early 1995, Bernie Dodge and Tom March at San Diego State University developed the model, which was outlined in Some Thoughts About WebQuests. Since then, instructors who have used the resources on this site have offered scores of workshops to teachers on the format.

Filamentality Web Site

http://www.kn.pacbell.com/wired/fil/

Filamentality is a fill-in-the-blank interactive Web site that guides teachers through picking a topic, searching the Web, gathering good Internet sites, and turning Web resources into learning activities. It helps combine the "filaments" of the Web with a learner's "mentality." Support is built-in through Mentality Tips that guide teachers along the way to creating Web-based activities that can be shared with others. Users don't even have to know much about HTML to benefit from this curriculum-planning tool.

doing well. Even reluctant teachers can become interested in the technology because of their students' enthusiasm.

Another researcher emphasized the importance of ongoing technological training for teachers. One-shot workshops, this interviewee argued, are not effective in this realm. Achieving such comprehensive training, though, is challenging in an environment where scarce professional development time may be geared toward meeting demands for basic skills and strong test results.

Teachers' Perspectives

Teachers who gave interviews during this study offered many concrete suggestions for helping inservice teachers master the use of the Internet for instruction, including:

- Convening small groups of teachers to work collaboratively to develop skills and approaches
- Linking new users with mentors
- Providing models of how teachers use the Internet for specific content areas

- Creating opportunities for one-on-one instruction for individual teachers, perhaps through a district resource person who can help teachers with individual questions and offer individual training
- Giving teachers time to learn new technologies, uses and ways of integrating Internet activities into their work.

One striking finding from the teacher interviews was that all of the participants in the study reported that they taught themselves how to use the Internet and deploy it as an instructional tool. Though one interviewee also mentioned that he is part of a community of learners at his school that explores Internet-use together, none cited formal pre- or inservice training as the foundation of their mastery of using the Internet in the classroom.

Table 4

The survey asked respondents: "Rate your *level of proficiency* in applying each of the following technology skills to effectively use the Internet for learning activities with students."

Respondents' level of proficiency in the following skills	***Mean*** n=56
Using the basic features of email such as creating, sending, and reading messages	4.9
Using the basic functions of a word processor such as creating and saving documents, changing fonts and styles, and printing documents	4.9
Locating resources on the Internet that are appropriate to lesson planning	4.8
Using basic features of an Internet browser (e.g. Netscape or Internet Explorer) to access Web sites such as conducting searches, navigating site maps and hot links	4.8
Using advanced features of a Web browser such as managing bookmark files, changing helper applications, installing plug-ins, or subscribing to services	4.6
Using the Internet to engage in professional collaboration such as email to follow up on meetings, conducting Web searches for professional events, or corresponding with students and parents	4.5
Using the advanced features of email such as creating and managing an address book, creating rules for automatic filing, subscribing and unsubscribing to listservs, and attaching files	4.5
Evaluating the quality and authority of Web sites	4.3
Evaluating the quality and authority of online groups	3.9
Using collaborative applications that allow users to file share on the Internet	3.9
Creating multimedia products for Web publishing	3.7

The teachers surveyed rated themselves proficient or highly proficient in eight of the eleven technology skills listed. In three areas of proficiency, this group said they were only somewhat proficient. Their ratings suggest that even among these educators who regularly use the Internet for their own professional purposes and with the students, there is a lack of proficiency in using the Internet for collaboration and Web publishing. Such activities involve not only using the Internet as consumers of resources but as active participants in online cultures.

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Table 5

The survey asked respondents: "Rate the level of importance you believe teacher proficiency plays in each of the following technology skills in order to effectively use the Internet for learning activities with students."

Rank order according to importance of teacher proficiency	***Mean*** n=56
Using basic features of an Internet browser (e.g. Netscape or Internet Explorer) to access Web sites such as conducting searches, navigating site maps and hot links	4.7
Locating resources on the Internet that are appropriate to lesson planning	4.6
Evaluating the quality and authority of Web sites	4.4
Using the basic functions of a word processor such as creating and saving documents, changing fonts and styles, and printing documents	4.4
Using the basic features of email such as creating, sending, and reading messages	4.3
Using advanced features of a Web browser such as managing bookmark files, changing helper applications, installing plug-ins, or subscribing to services	4.1
Evaluating the quality and authority of online groups	4.1
Using the Internet to engage in professional collaboration such as email to follow up on meetings, conducting Web searches for professional events, or corresponding with students and parents	4.0
Creating multimedia products for Web publishing	3.7
Using the advanced features of email such as creating and managing an address book, creating rules for automatic filing, subscribing and unsubscribing to listservs, and attaching files	3.7
Using collaborative applications that allow users to file share on the Internet	3.5

Those survey respondents rated four technology know-how skills as important or very important when it comes to effectively using the Internet for learning activities with students. The technology skills involve proficiency in using basic features of Internet browsers, word processing, email, and advanced browser functions. In addition, information research and some collaboration proficiencies were rated as important or very important when it comes to effectively using the Internet for learning activities with students. Three other teacher proficiencies they rated as only somewhat important involve using the Internet for collaboration and Web publishing. It is interesting to note that the collaboration and Web publishing proficiencies that researchers said are very important are not rated consistently high by teachers.

When survey respondents were asked to answer the open-ended question, "I learned to use the Internet effectively in my teaching practice by..." (Question 5), several patterns emerged. The most common response was that respondents taught themselves by exploring and by trial and error. The next most common survey response was that they had learned to use the Internet in professional development training offered by their school or district. Taking courses, working with other teachers, and reading professional journals were mentioned, but much less frequently.

Reflecting on the Findings

The issue is not just access to the new media, but rather whether differences in availability of services, technology fluency, motivation, and opportunities to learn may lead to a two-tiered world of knowers and know-nots, doers and do-nots.

Don Tapscott
Growing Up Digital: The Rise of the Net Generation, 1998

The focus of this study was to explore literacy researchers and lead teachers' thinking about the benefits of Internet-based curricular activities and instructional practices used to enhance students' literacy.

The findings from this study indicate a number of educational benefits study participants associate with using the Internet. Teachers surveyed said they observe that Internet-based learning activities make reading enjoyable for students, foster use of critical reading skills, and facilitate students' reading fluency. They also observe that these activities enhance understanding of content. Interestingly enough, we found that these teachers and researchers believe students need well-developed basic literacy skills in order to benefit from Internet-based opportunities. In addition, traditional reading and writing skills that survey respondents said students achieve when using the Internet include vocabulary development, process writing skills, and comprehension of text. Those interviewed and surveyed in this study also indicated that higher-order literacy skills, such as organizing information research according to a research question, comparing and contrasting, and synthesizing information into new and meaningful structures, are important when engaging in Internet-based literacy activities.

The findings highlight a prevalent instructional practice among participants:

- Individualizing the Internet-based activities helps meet the diverse needs of their students.
- Customizing learning for students is inherently motivating to students.
- Students who are motivated to learn often take responsibility for their learning.
- Taking responsibility fosters self-directed learning habits that the researchers and teachers indicate are not only vital to but also achievable through Internet-based literacy learning.

Most teachers, however, are not taught how to foster students' self-directed learning habits. In addition, it appears from this study that teachers need to have well-developed self-directed learning habits themselves in order to research and develop teaching and learning strategies pertinent to Internet-based education. However, reaching a critical mass of teachers able to effectively use the Internet for educational purposes requires a shift from teacher-centered to learner-centered practices.

The findings from this study bring to the foreground a concern about the preparation programs available to teachers. Most survey respondents and interviewees in this study reported that they taught themselves how to use the Internet in the classroom. More formal sources of training, such as preservice education and inservice professional development, were much less common. One implication is that to help a wider group of teachers meet the challenges of using the Internet effectively with students, pre- and inservice training programs will need to do more to prepare teachers for classroom use of this technology. State and local school policies are needed to guarantee that all teachers have ready access to the Internet anywhere, anytime to engage in the emerging online professional development communities and programs that can help them become proficient in Internet-based curriculums and instruction. With several states now looking into establishing online virtual schools with a wide range of course offerings, teaching on the Internet is likely to be in high demand.

Most survey respondents and interviewees in this study reported that they taught themselves how to use the Internet in the classroom. More formal sources of training, like preservice education and inservice professional development, were much less common. One implication is that to help a wider group of teachers meet the challenges of using the Internet effectively, pre- and inservice training programs will need to do more to prepare teachers for classroom use of this technology.

The literature, and the group of researchers interviewed for this study, places a great deal of importance on the value of the Internet as a vehicle for participa-

tion and exchange. The teachers participating in our survey, however, were more likely to have their students use the Internet for research and publishing than for participation in online communities. Among survey participants, two possible explanations emerged. First, their institutions' acceptable-use policies may make it difficult to use the Internet for these purposes. In the survey, "participation in online discussions" and "email correspondence" were the two uses most likely to be disallowed by respondents' institutions. If such restrictions are common, schools could explore ways to allow more collaboration and exchange while still protecting students online. Second, teachers responding to the survey gave themselves relatively low ratings for proficiency in some participatory activities, like evaluating online groups and using collaborative applications. This finding, if reflective of broader trends, indicates that more schools need to adopt acceptable use policies and incentives that foster teachers' use of the Internet for collaboration and Web publishing in addition to being an information resource.

For some readers, the curricular activities and instructional practices highlighted in this report may appear to be out-of-reach or unnecessary to meeting student learning standards. And there is little doubt that for some, engaging in the types of activities our participants describe would require making sweeping changes. We acknowledge that changes are needed to use the Internet effectively in the classroom, and we suggest that the Internet can be used to achieve the student and teacher standards identified at the beginning of our report.

Teachers are central to implementing any change within a school system, and an Internet-based curriculum is no exception. According to Becker (1999), "to a large degree, teaching students to use computer resources such as the Internet remains a specialized province of the 'computer teacher' rather than having been integrated into the instructional repertoire of teachers across all subjects" (p. 11). However, teachers of humanities classes, including social studies and English, demonstrated slightly higher use and perceived value of the Internet as compared with other teachers (Becker, 1999). English language arts teachers, expert in fostering students' development of reading and writing skills for use across the curriculum and beyond, have an unique role to play in effectively implementing uses of the Internet in education. Teachers and aspiring teachers need to have ready access to the resources and professional support needed to meet the challenge of preparing today's youth with literacy skills applicable to the twenty-first century.

ENDNOTES

1. According to the National Center for Education Statistics, 95 percent of public schools and 63 percent of instructional rooms in those schools were connected to the Internet in the fall of 1999, and classroom connectivity is expected to continue growing (February 2000).
2. The request for participation issued to researchers and the researcher questionnaire are available from the authors upon request.
3. Of the 13 interviewed teachers, 12 taught English and one taught social studies in the following states: Illinois, Massachusetts, Michigan, New Jersey, New York, Virginia, and Wisconsin. Of these, the five observed English teachers taught in Illinois, Massachusetts, and New Jersey. Four of the five observed teachers taught high school; one taught elementary school.
4. The call for participation, teacher questionnaire, and observation protocol are available from the authors upon request.
5. Survey respondents, who we coded as staff developers, listed the following occupational titles other than classroom teacher for Question #35 (which reads: "If you are not currently a classroom teacher, identify your occupational title in the textbox provided."): preservice and inservice faculty, district- or building-level technology coordinator, computer teacher or trainer, librarian or media services specialist, peer coach/mentor, teacher specialist, and coordinator of gifted education.
6. Data in this paragraph is based on responses to survey questions 24 (state) and 26 (type of community).
7. Since some staff developers reported multiple levels of service, these percentages add up to more than the full sample size of 57.
8. Data in this paragraph is based on responses to survey question 32.
9. Data in this paragraph is based on responses to survey questions 1 (respondents' usage) and 2 (respondents' students' usage).
10. Data in this paragraph is based on responses to survey questions 27 (respondents' access) and 28 (respondents' students' access).
11. Data in this paragraph is based on responses to survey question 30.

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Internet-Based Reading and Writing Across-the-Curriculum Educator Survey

Respond with the appropriate answer for each of the following items.

1. On average, I use the Internet for educational/professional purposes during the week (check only one answer):

- O Less than 15 minutes per week
- O 15-45 minutes per week
- O 46-90 minutes per week
- O More than 90 minutes per week

2. On average, each of my students engages in Internet-based reading and writing activities during the week (check only one answer):

- O Less than 15 minutes per week
- O 15-45 minutes per week
- O 46-90 minutes per week
- O More than 90 minutes per week

If your response to either of the above questions is "Less than 15 minutes per week," please do not continue with the survey.

Complete each of the following sentence starters by typing your response in the textbox provided.

3. I began using the Internet in my teaching practices because . . .

answer here

4. I have observed that the Internet affects students' reading and writing skills in the following ways . . .

answer here

5. I learned to use the Internet effectively in my teaching practices by . . .

answer here

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6. Rate the level of importance you think each of the following skills plays in students' effective use of the Internet. Assign your rating on a scale from 1 to 5.

1 = not at all important
2 = slightly important
3 = somewhat important
4 = important
5 = very important

Rate the level of importance.	1	2	3	4	5
Using search engines to identify sources relevant to a topic	O	O	O	O	O
Using email to correspond with experts about a topic	O	O	O	O	O
Evaluating search engine responses	O	O	O	O	O
Checking the date on Web pages	O	O	O	O	O
Assessing the reputation of a Web site's publisher	O	O	O	O	O
Recognizing how pertinent information is to a topic	O	O	O	O	O
Organizing large volumes of information about a topic	O	O	O	O	O
Understanding the bias of any Web resource	O	O	O	O	O
Organizing a research question before beginning to gather information	O	O	O	O	O
Staying focused on topic	O	O	O	O	O
Using Web conventions such as text links, site maps, or bookmarked Web addresses to navigate	O	O	O	O	O
Engaging in simulations such as MOOS	O	O	O	O	O
Accurate keyboarding	O	O	O	O	O
Integrating images with appropriate text	O	O	O	O	O
Categorizing information on a topic	O	O	O	O	O
Presenting electronic information succinctly	O	O	O	O	O

Revising written work for Web publishing	O	O	O	O	O
Understanding the level of formality needed in different contexts	O	O	O	O	O
Understanding how to convey emotions online	O	O	O	O	O

7. Specify other skills students need to use the Internet effectively in the textbox provided:

None

---

8. In my opinion, use of the Internet plays a significant role in helping my students achieve the followin (check all that apply):

- ☐ Vocabulary development
- ☐ Comprehension of narrative text
- ☐ Comprehension of expository text
- ☐ Written responses to literature
- ☐ Written responses to expository text
- ☐ Engagement in learning community discussions
- ☐ Process writing skills
- ☐ Information research skills
- ☐ Personal engagement in reading and writing activities
- ☐ Self-directed learning
- ☐ Publishing for real audiences

9. Specify other reading and/or writing goals in the textbox provided

None

---

10. Based on your experience with Internet-Based learning activities, rate each statement below according to how often you observe its benefit occurring for your students. Assign your rating on a scale from 1 to 5. If you have not engaged in the activity, check "n/a."

1 = never observe benefit
2 = occasionally observe benefit
3 = sometimes observe benefit
4 = often observe benefit
5 = always observe benefit

Rate how often benefit is observed.	**1**	**2**	**3**	**4**	**5**	**n/a**
Provides accurate information resources	O	O	O	O	O	O
Expands the variety of resources available	O	O	O	O	O	O

Promotes active student reading	O	O	O	O	O	O
Promotes active student writing	O	O	O	O	O	O
Enhances collaborative discussions	O	O	O	O	O	O
Hones technology skills	O	O	O	O	O	O
Enhances writing for different audiences	O	O	O	O	O	O
Promotes student involvement in community issues	O	O	O	O	O	O
Promotes community involvement in students' literacy development	O	O	O	O	O	O
Facilitates authentic, real-life literacy experiences	O	O	O	O	O	O
Fosters use of critical reading skills	O	O	O	O	O	O
Fosters use of creative writing skills	O	O	O	O	O	O
Fosters use of technical writing skills	O	O	O	O	O	O
Enhances understanding of content	O	O	O	O	O	O
Makes reading enjoyable	O	O	O	O	O	O
Makes writing enjoyable	O	O	O	O	O	O
Customizes reading experiences for students	O	O	O	O	O	O
Customizes writing experiences for students	O	O	O	O	O	O
Facilitates writing fluency	O	O	O	O	O	O
Facilitates reading fluency	O	O	O	O	O	O
Provides context cues for understanding new vocabulary	O	O	O	O	O	O

11. The criteria I use in deciding when the Internet is the appropriate tool for reading and/or writing activities are (check all that apply):

- ☐ The scope of available resources
- ☐ The nature of available resources
- ☐ The reading level of available resources
- ☐ Efficiency of completing a learning activity
- ☐ Convenience for completing a learning activity

12. Specify other criteria in the textbox provided:

None

13. I plan for Internet-based writing and/or reading activities by (check all that apply):

- ☐ Conducting a pre-search to help guide students in their inquiry
- ☐ Building a Web site that provides students with appropriate links

- ☐ Building an online model to help guide students through the assignment
- ☐ Designing assignments that allow students to pursue individual interests
- ☐ Doing the project myself to gauge how long it will take

14. Specify other planning activities in the textbox provided:

None

15. My teaching role during an Internet-based learning activity involves (check all that apply):

- ☐ Walking around the room to offer assistance with student questions
- ☐ Asking individual students to reflect on their work-in-progress
- ☐ Leading individual students through activities step-by-step
- ☐ Assessing individual students' skills
- ☐ Encouraging students to choose their role within a group project
- ☐ Modifying assignments to meet the needs of diverse learners
- ☐ Encouraging students to work at their own pace

16. Specify other roles in the textbox provided:

None

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17. I assess students' effective use of the Internet, based on their ability to do the following (check all that apply):

- ☐ Spend time locating information on a topic
- ☐ Access depth of information on a topic
- ☐ Meet deadlines
- ☐ Provide accurate answers to literal questions
- ☐ Provide plausible answers to inferential questions
- ☐ Provide valid answers to evaluative questions
- ☐ Read text accurately
- ☐ Read text fluently
- ☐ Interpret motives of online correspondents
- ☐ Relate information on the Web to personal experiences
- ☐ Recognize text structures or patterns
- ☐ Use new vocabulary in context
- ☐ Compare and contrast information sources
- ☐ Synthesize multiple sources on a topic
- ☐ Organize information elements into a new and meaningful structure

18. Specify other indicators for assessing students in the textbox provided:

None

19. Rate your level of proficiency in applying each of the following technology skills to effectively use the Internet for learning activities with students. Assign a rating on a scale from 1 to 5.

1 = not at all proficient
2 = slightly proficient
3 = somewhat proficient
4 = proficient
5 = highly proficient

Rate your level of proficiency	1	2	3	4	5
Using the basic functions of a word processor such as creating and saving documents, changing fonts and styles, and printing documents	O	O	O	O	O
Using the basic features of e-mail such as creating, sending, and reading messages	O	O	O	O	O
Using the advanced features of e-mail such as creating and managing an address book, creating rules for automatic filing, subscribing and unsubscribing to listservs, and attaching files	O	O	O	O	O
Using basic features of an Internet browser (e.g. Netscape or Internet Explorer) to access Web sites such as conducting searches, navigating site maps and hot links	O	O	O	O	O
Using advanced features of a Web browser such as managing bookmark files, changing helper applications, installing plug-ins, or subscribing to services	O	O	O	O	O
Locating resources on the Internet that are appropriate to lesson planning	O	O	O	O	O
Using the Internet to engage in professional collaboration such as e-mail to follow up on meetings, conduct web searches for professional events, or correspond with students and parents	O	O	O	O	O
Evaluating the quality and authority of Web sites	O	O	O	O	O
Evaluating the quality and authority of online groups	O	O	O	O	O
Using collaborative applications that allow users to file share on the Internet	O	O	O	O	O
Creating multimedia products for Web publishing	O	O	O	O	O

20. Rate the level of importance you believe teacher proficiency plays in each of the following technology skills in order to effectively use the Internet for learning activities with students. Assign a rating on a scale from 1 to 5.

1 = not at all important

2 = slightly important
3 = somewhat important
4 = important
5 = very important

Rate the level of importance.	**1**	**2**	**3**	**4**	**5**
Using the basic functions of a word processor such as creating and saving documents, changing fonts and styles, and printing documents	O	O	O	O	O
Using the basic features of e-mail such as creating, sending, and reading messages	O	O	O	O	O
Using the advanced features of e-mail such as creating and managing an address book, creating rules for automatic filing, subscribing and unsubscribing to listservs, and attaching files	O	O	O	O	O
Using basic features of an Internet browser (e.g. Netscape or Internet Explorer) to access Web sites such as conducting searches, navigating site maps and hot links	O	O	O	O	O
Using advanced features of a Web browser such as managing bookmark files, changing helper applications, installing plug-ins, or subscribing to services	O	O	O	O	O
Locating resources on the Internet that are appropriate to lesson planning	O	O	O	O	O
Using the Internet to engage in professional collaboration such as e-mail to follow up on meetings, conduct web searches for professional events, or correspond with students and parents	O	O	O	O	O
Evaluating the quality and authority of Web sites	O	O	O	O	O
Evaluating the quality and authority of online groups	O	O	O	O	O
Using collaborative applications that allow users to file share on the Internet	O	O	O	O	O
Creating multimedia products for Web publishing	O	O	O	O	O

21. Specify additional proficiencies in the textbox provided:

None

Providing the following demographic information will help NCREL in their data analysis. Your name and e-mail address are requested for feedback purposes only and will be kept strictly confidential.

22. Name: optional

23. School Zip Code:

5 digits only

24. State (Click here to choose)

25. Email Address: optional

26. The school that you teach at is categorized as (check only one):

- O Urban
- O Rural
- O Suburban

27. You have Internet access (check all that apply):

- ☐ At home
- ☐ In the classroom
- ☐ In a resource center
- ☐ In an administrative office

28. The location of computers with Internet connections that your students have access to are (check all that apply):

- ☐ My classroom
- ☐ School computer lab
- ☐ School media center

29. Specify other location(s) in the textbox provided:

None

30. Your school's acceptable use policy allows students to use the Internet for (check all that apply):

- ☐ Email correspondence
- ☐ Participating in online discussions
- ☐ Web publishing
- ☐ Information research
- ☐ Participation in collaborative projects

31. Specify other acceptable use(s) in the textbox provided:

None

32. You use the Internet for which content areas learning goals (check all that apply):

- ☐ English/Language Arts
- ☐ Fine Arts
- ☐ Health
- ☐ History/Social Studies
- ☐ Interdisciplinary
- ☐ Mathematics
- ☐ Science

33. Specify other content areas in the textbox provided:

None

34. Identify the grade level(s) you are currently teaching (check all that apply):

☐ K	☐ 5	☐ 10
☐ 1	☐ 6	☐ 11
☐ 2	☐ 7	☐ 12
☐ 3	☐ 8	☐ Preservice
☐ 4	☐ 9	☐ Inservice

35. If you are not currently a classroom teacher, identify your occupational title in the textbox provided: occupation

The information you provide in this survey will be aggregated and held in strict confidence by NCREL. No responses will be associated with any individual person in the research report.

Submit Survey